

# Wrinkles in time

Identifying ecological regime shifts in the Northeast Atlantic from phyto- and zooplankton records, and using machine learning to predict when they will occur in the future

**Paul Dees**  
[paul.dees@uib.no](mailto:paul.dees@uib.no)  
Department: GFI

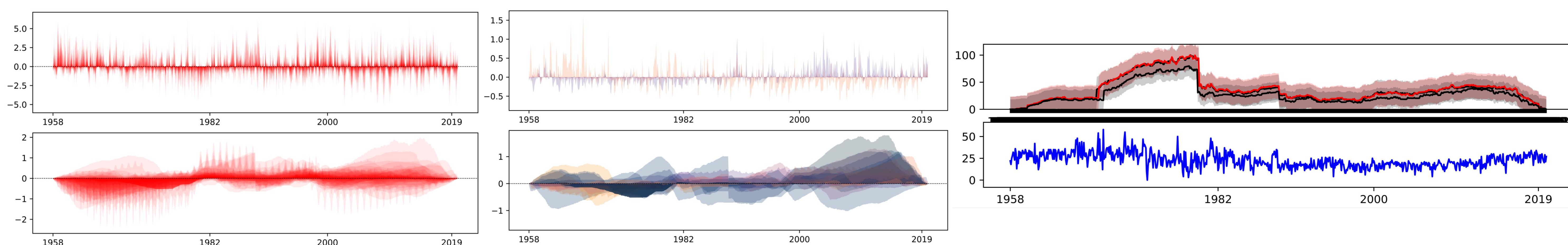
## Background and motivation

My PhD and Master's degrees were focussed on harmful algal blooms and their transport to the coast. In Bergen, I am studying changes in all microalgae and zooplankton species for which there are records in the Northeast Atlantic. The longest running records go back to the middle of the last century. These records are useful for detecting trends, even though they are temporally and spatially inconsistent. Finding evidence of large ecological regime shifts based on uneven plankton datasets is challenging, but predicting when they occur is important for future life on Earth...

## Project description

I am looking for evidence of large ecological regime shifts in established plankton datasets. Regime shifts can be defined as a change from one stable state to another. A famous example of this is the change from coral reefs dominating the Caribbean Sea until the 1980s, after which the ecosystem shifted to one dominated by macroalgae. At least two regime shifts between different communities of plankton have been recorded in the North Sea, but a method to predict them has not been found yet.

I want to develop a machine learning algorithm which can be trained to look for where regime shifts are likely to occur, using modelled physical (abiotic) data. Physical datasets are maintained easier and at lower costs than ecological (biotic) data, and can reliable future forecasts have been made. An accurate method of predicting when regime shifts happen using modelled physical data would therefore be beneficial as the Anthropocene (or *Capitalocene*) progresses. If you are interested, ask me about these graphs!



## Main questions

- Where have regime shifts occurred in the past?
- What physical attributes describe these regions?
- What physical changes occurred at the same time as regime shifts?
- When are regime shifts likely to occur in the future?

## Highlighted results (and/or activities)

### Collaboration within SEAS

- Coauthored a commentary piece concerning deep sea mining activities and the International Seabed Authority, with another SEAS fellow (rejected and being rewritten). Another commentary piece on gender is still in review.
- Helped write two proposals with other SEAS fellows – once concerning a multimedia project and another about the Ocean decade and inequalities

### Outreach

Written several blog posts on the SEAS blog [www.seas.w.uib.no/](http://www.seas.w.uib.no/)  
Recorded a SEAS podcast episode with fellow Juan Manuel Valero



### Other publications

Can be found on my UiB webpage – following the QR code!

## Marine sustainability

Plankton form the base of the food chain in the pelagic Ocean. Predicting large changes to plankton populations can therefore be an important step for early detections of changes to the abundance of higher trophic levels.

## Aims (and/or milestones)

- Obtain ecological data from long-term datasets ✓
- Develop reliable method to detect past regime shifts ✓
- Find acceptable ways of dividing study area into subareas ✓
- Learn about how best to implement machine learning algorithm to predict future events ✓
- Obtain physical data ✓
- Develop machine learning method which can detect regime shifts in testing data and predict future regime shifts 
- Publish more work in scientific journals 

## Supervisory team

Christoph Heinze (UiB, retiring end of 2023)  
Morten Skogen (IMR)

Truls Johannessen and Friederike Fröb (UiB) will be taking supervision over from Christoph in 2023



SEAS

